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CHAPTER 3 DECKS

SECTION 3.1 INTRODUCTION

Decks are structural components of a bridge, and serve several functions. The wearing surface of a deck provides a smooth riding surface for traffic. The deck distributes the bridge live loads such as vehicle wheel loads to the girders, stringers, and floor beams. Reinforced concrete decks also serve as the top flange of reinforced concrete T-beam bridges, and reinforced concrete decks may function as part of the top flange of steel open girder, steel box girder, prestressed concrete, and concrete box girder bridges. For concrete slab bridges, the deck is also the superstructure.

Decks receive a considerable amount of abuse from truck overloads; corrosive deicing chemicals; freeze/thaw weathering; and parasites/fungi and other sources that cause wear and abrasion, such as wheels, snow plow blades, and road debris. Decks can deteriorate rapidly and must be monitored diligently.

SECTION 3.2 CONCRETE DECKS

Concrete decks are the most common type of deck an inspector will encounter. The inspector should review the bridge history to confirm the construction details for each deck. The history should include information about any overlays, the year each overlay was constructed, the design load, if the steel is coated with epoxy, and whether or not the deck is composite with the superstructure. There are several types of concrete decks:

- Concrete decks that are cast on the superstructure on-site are referred to as cast-in-place. Forms are used to contain reinforcing bars and wet concrete so that after curing, the deck components will be in the correct position and shape. Bar chairs are used to support reinforcement in the proper location during casting. Removable forms are usually wood planking or plywood, but can also be fiberglass reinforced plastic. These forms are removed from the deck after the concrete has cured. Corrugated metal sheets, fiber reinforced precast concrete, and polymers are common materials used for stay-in-place forms.
- Precast deck panels are cast and cured off-site. Precast deck panels are typically reinforced with conventional mild reinforcement. The panels are transported to the bridge site, placed on the superstructure, leveled, and attached to the superstructure/floor system. The panels are either bolted to the stringers with mechanical clips, or attached using grout or concrete filled block-out holes as shear connectors.
- Pre-cast, prestressed deck slabs are cured off-site. They are reinforced with prestressing steel in addition to some mild reinforcement. The prestressing tendons or bars are tensioned prior to placing the slab (pretensioned) or after the slab is cured (post-tensioned). This creates compressive forces in the slab, which reduce the amount of tension cracking in the cured concrete.

Figure 4:3-1: Epoxy-Coated Deck Reinforcement

Concrete deterioration normally starts in the wearing surface and along the copings, joints, or curb lines and progresses downward and inward until the entire slab is involved. Therefore, when deterioration is observed on the bottom of a slab, there is a good chance that the deterioration is worse above this point and the deck should be rated accordingly.

A bituminous overlay can accelerate the deterioration of the deck, as well as hide patches, spalls, delaminations, and repairs in the original deck or debonding of an overlay from the deck. Repaired and distressed areas which are known to exist through historical documentation or previous inspection reports need to be taken into account when assigning a rating to the deck. Inspectors should state the source of any information beyond visual inspection of the wearing surface. Chain dragging or other soundings may provide knowledge about distress under an overlay and should be used when deterioration is suspected.

Technically advanced means of evaluating a wearing surface or concrete deck include ground-penetrating radar and infrared thermograhy. These are seldom used due to cost and effort limitations, but it may be appropriate to utilize these tools for large bridges with high average daily traffic (ADT).

The inspection of concrete decks should include a thorough evaluation of the wearing surface, copings, curb lines, and the underside of the deck for the following items:

- Check for cracks, note their location, orientation, length, maximum width, and type. The extent of cracking gives an indication of how much water is able to penetrate the deck. Cracks to note include:
    - Longitudinal flexural cracks caused by deck positive bending between the girders or stringers. Wide cracks may indicate a serious structural overload.
    - Longitudinal flexural cracks in areas of negative moment bending over the girders or stringers in the deck.
    - Transverse flexural cracks adjacent to and over piers, where reinforcement bars end, and over floor beams.
    - Diagonal or transverse temperature/shrinkage cracks. These will be found on most concrete decks and can provide a means for chlorides to reach steel reinforcement.
- Check for pop-outs, scaling, abrasion, and rutting. This may be most evident in the gutters and around the drains.
- Look for spalls and note any large individual spalls.
- Look for signs of corroding reinforcing steel, such as rust stains.
- Note exposed reinforcing steel, corrosion, or loss of section.
- Check for efflorescence. Note if it is stained with rust, since this condition suggests reinforcing steel corrosion.
- Check for areas of delaminations. Loose concrete can fall and cause serious damage or injury.
- Note all collision damage.
- Check for sagging.
- Note distressed repair areas.
- Check for water leakage. Frequently, water leakage appears on support structures, under drains, or under expansion joints.
- Check for excessive deflection under live loads and listen for unusual sounds with the passage of live loads.
- Check stay-in-place forms for corrosion and other signs of leakage through the deck. Stay in place forms may trap moisture and hide the condition of a deck.
- Check the deck at the railing and/or light standard connections.

SECTION 3.3 STEEL DECKS

Steel decks are sometimes used on bridges because they weigh less than concrete decks. They are often used on movable bridges to reduce the required counterweight needed to balance the span. Steel decks have been used to replace concrete decks on older bridges when an increased live load capacity is desired, or when existing superstructure or substructure elements do not have enough strength to support the heavier dead load of a concrete deck.

Subsection 3.3.1 Steel Grid Deck

Steel grid decks are the most common type of steel deck. Steel grid decks contain several components that are either welded or riveted together, including bearing bars, cross bars, and supplementary bars. Openings between these bars may be filled with concrete to improve the durability of a steel grid deck. Exodermic decks are a type of steel grid system utilizing a reinforced concrete slab placed on top of the steel grid. The concrete acts compositely with the grid.

Steel open grid decks are strong and lightweight. Open grids are prefabricated using rectangular bars and delivered to the bridge site in several panels, which are then connected to the superstructure. The tops of the bars may be serrated to provide a skid-resistant riding surface.

Steel open grid decks are constantly exposed to the elements. Even though they are often galvanized or painted, traffic wear quickly exposes the deck top surface, leaving the deck vulnerable to corrosion. Open grids also leave the superstructure exposed to roadway debris, rain, and deicing chemicals.

On concrete and bituminous concrete-filled steel grid decks, the steel grid serves as the deck's structural component. The material between the bar openings offers better corrosion protection and a more durable riding surface than an open deck. The deck system provides some protection for the superstructure below from rain, deicing chemicals, and roadway debris. Filled steel grid decks are heavier than open grid decks, but lighter than traditional concrete decks. The fill of these elements may be placed flush with the top layer of bars or preferably overfilled 1 to 2 inches. The bottom of the fill may be flush with the bottom of the grid or at mid-depth of the main bars.

Figure 4:3-2: Open Steel Grid Deck

The inspection of steel grid decks should include a thorough evaluation of the top, bottom, and sides of the deck for the following items:

- Examine the bearing bars in the bearing areas at stringers/girders for cracked welds or broken fasteners. Special attention should be paid to the tension areas of the bars.
- Examine welds attaching the deck to the stringers or girders to ensure cracks are not developing.
- Look for twisted, cracked, broken, or missing bars, particularly at bearing bars.
- Check for corrosion and related section loss.
- Look for worn serrations or excessive wear causing section loss or broken welds between the bars.
- Listen for any rattling as traffic passes over the deck. Rattling suggests loose, broken, or missing fasteners.
- Look for broken fasteners on bolted or riveted steel grid decks.
- Check any repair plates placed over the grid to make sure they are still securely fastened.
- Check for grid expansion at the joints and bridge ends. This is often caused by corrosion.
- Check for bowing of the deck panels.

- Look for filler that is cracked, broken, leaking, or missing altogether.
- Check for excessive deflection under live loads and listen for unusual sounds with the passage of live loads.

Subsection 3.3.2 Steel Orthotropic Decks

Steel orthotropic decks are often used on long span bridges for their light weight. An orthotropic deck consists of a flat steel plate with longitudinal stiffeners welded to the underside of the plate. The floor beams of the bridge act to stiffen the deck perpendicular to the length of the bridge. Orthotropic decks may act as the top flange of the superstructure primary members, reducing the total bridge dead load. The deck surface usually includes a manufacturer-applied coating.

The inspection of steel orthotropic decks should include a thorough evaluation of the top, bottom, and sides of the deck for the following items:

- Check for corrosion of the steel plate or stiffeners.
- Check for leakage.
- Check for proper support.
- Look for cracked or broken stiffeners, welds, and connectors.
- Listen for rattling as traffic passes over the deck. Rattling suggests loose, broken, or missing fasteners.
- Check for excessive deflection under live loads and listen for unusual sounds with the passage of live loads.
- Check for failure of the wearing surface coating.

Subsection 3.3.3 Steel Railroad Car Decks

When reclaimed railroad cars are used as bridges, the bridge deck is the floor of the original rail car. They may be overlaid with an asphaltic wearing surface or timber decking. These reclaimed structures were likely exposed to many load cycles before being re-used as bridges and should be carefully inspected.

The inspection of steel railroad car decks should include a thorough evaluation of all visible portions of the top, bottom, and sides of the deck for the following items:

- Check for corrosion of the steel flooring or stiffeners.
- Check for leakage.
- Check for proper support.

- Look for cracked or broken stiffeners, welds, and connectors.
- Check for excessive deflection under live loads and listen for unusual sounds with the passage of live loads.

Subsection 3.3.4 Steel Corrugated Flooring

This deck type uses corrugated steel plates spanning transversely between the girders or stringers. After the flooring is fastened to the superstructure, the corrugations are filled with asphalt. This deck system can trap and hold water that passes through the topping, making it very susceptible to corrosion. The corrosion often cannot be seen until the corrosion extends through the thickness of the corrugated plate.

The inspection of steel corrugated decks should include a thorough evaluation of the top, bottom, and sides of the deck for the following items:

- Check for corrosion of the steel plate.
- Check for cracked or broken-up areas of asphalt that would allow water penetration.
- Check for areas of asphalt that look “settled.” This may indicate that the steel plates below are deforming or sagging.
- Check for leakage.
- Check for proper support.
- Look for cracked or broken welds and connectors.
- Examine the welds attaching the deck to the stringers or girders to ensure cracks are not developing.
- Listen for rattling as traffic passes over the deck. Rattling suggests loose, broken, or missing fasteners.
- Check the wearing surface for rutting or spalls and note any large individual spalls.
- Check for excessive deflection under live loads and listen for unusual sounds with the passage of live loads.

SECTION 3.4 TIMBER DECKS

Timber decks are normally used for timber superstructures, although they are occasionally found on other steel superstructures. Timber decks may also be referred to as decking or timber flooring. There are several types of timber decks:

- **Plank decks** – These are the most common type of timber deck. Deck planks are sawn timber planks laid flat across the tops of the timber beams or steel stringers. They span transversely between the beams/stringers and are fastened to the superstructure with nails or bolt clamps. Common planks are three-to-six inches thick and 10-to-12 inches wide.
- **Nail laminated decks** – This deck type uses sawn planks laid on edge across the tops of the timber beams or steel stringers, creating a very stiff deck. Each plank is placed tight against and nailed to the adjacent one. When used in conjunction with timber superstructures, each plank is toe-nailed to the beam. When used in conjunction with steel superstructures, the deck is attached with clamps at regular intervals.
- **Glued laminated decks** – These decks are similar to nail laminated decks, but the planks are glued together in a factory and shipped to the job site in three-to-five-foot wide planks. After setting the planks on top of the superstructure, the planks are clamped together for the full length of the bridge by way of tie rods. The deck is then fastened to the beams/stringers using nails, bolts, clip angles, or nailers. Glued laminated decks are generally stronger, stiffer, and more water-resistant than plank or nail-laminated timber decks.
- **Prestressed laminated deck** – These decks use laminated timbers similar to nail and glued laminated decks. They are different in that external prestressing is used to clamp the laminations together. The individual laminations work together as a unit due to the large frictional forces generated by the prestressing. Normally, steel rods passing through the laminations are used to deliver the prestressing forces at approximately two-foot centers.

Because of timber's low resistance to abrasion, wearing surfaces are often used. These may be timber or steel running boards or a bituminous overlay. Running boards are placed longitudinal to traffic, usually along the wheel paths. They are easily replaced when worn. Bituminous wearing surfaces may be placed on any type of timber deck, although this can trap water against the timber. Bituminous surfaces tend to crack and deteriorate quickly on plank decks due to plank flexibility and differential deflection.

Figure 4:3-3: Timber Plank Deck

Figure 4:3-4: Steel Running Boards on a Timber Deck

The inspection of timber decks should include a thorough evaluation of the top, bottom, and sides of the deck for the following items:

- Look for signs of wear and abrasion, weathering, splitting, crushing, and decay.
- Look for loose, missing, or damp members.
- Check all bearing areas for decay and crushing. Crushing can be caused by decay or by overloads.
- Check for corroded, loose, or missing fasteners.
- Check tension areas for excessive deflections, fractures, and transverse cracks. These are typically signs of excessive flexural stresses and overloads.
- Hammer tap random and suspect areas to evaluate the wood's soundness.
- Perform probe tests where decay is suspected. Using an awl, ice pick, or pocketknife, lift a small sliver of wood from the surface. Wood that lifts up and splinters is sound, while wood that breaks up upon lifting the tool is decaying.
- Drill or bore suspect planks to estimate the extent of decay.
- Examine any overlay for signs of wear and abrasion, cracks, potholes, or impending potholes.
- Check for excessive deflection under live loads and listen for unusual sounds with the passage of live loads.
- Check for fire damage.
- Note the presence and condition of any insecticides, preservatives, or protective flashings or coverings.

SECTION 3.5 NBI DECK RATING

Deck condition ratings assess the current structural condition of the deck as compared to its original, as-built condition. Postings or original design capacities less than current legal loads will not influence the rating. Because only a single number is used to rate the deck, the rating must characterize its overall general condition. The rating should not be used to describe local areas of deterioration, but widespread deterioration would influence the rating. The rating must consider the extent and severity of the deterioration.

Temporary deck supports, bituminous overlays, partial concrete overlays, patching, and temporary strengthening methods do not improve the condition of the deck material or influence the deck rating.

On slab bridges, the deck is also the superstructure, so the ratings of the deck and superstructure must be the same.

Decks integral with the superstructure (rigid frame, box girder, etc.) will be rated as a deck only, and not how they may influence the superstructure rating. Similarly, the superstructure of an integral deck-type bridge will not influence the deck rating.

For some decks integral with the superstructure, such as adjacent box beams, you cannot see the underside of the deck and must rate the deck based on the top surface alone. If the bridge has an overlay, the deck rating will be based on an assessment of the condition of the overlay and any documented history of the concrete below the overlay.

Ratings of 9 to 7 apply to decks in good condition, 6 to 5 suggest fair condition, 4 to 3 suggest poor condition, 2 suggests critical condition, and 1 to 0 suggest a condition where the bridge must be closed to traffic. It is important to note that there is a significant change from a deck in condition rating 5 to condition rating 4. If the load-carrying capacity is reduced, the deck rating must be less than 5.

The condition of the wearing surface, protective systems, joints, expansion devices, curbs, sidewalks, parapets, fascias, bridge rail, and scuppers shall not be considered in the overall deck evaluation of National Bridge Inspetion Standards (NBIS) Item 58, Decks. However, these items should be evaluated and reported as described in Subsection 3.5.2

The general condition ratings and Indiana supplemental rating guidelines for decks are as follows.

Code (Rating) Description

N NOT APPLICABLE

Supplemental Rating Guidelines: Used for structures without decks such as underfill structures or filled arch bridges.

9 EXCELLENT CONDITION

Supplemental Rating Guidelines: Generally used on properly constructed new bridges.

Concrete Deck – There are no spalls, delaminations, cracks, or scaling present.

Steel Deck – There are no deficiencies which affect the deck condition.

Timber Deck – There are no deficiencies which affect the deck condition.

8 VERY GOOD CONDITION – No problems noted.

Supplemental Rating Guidelines: Generally used on properly rehabilitated bridges or bridges in nearly new condition.

Concrete Deck – There are no spalls, delaminations, cracks, or scaling present. Minor transverse cracks may be present in the deck surface or the underside of the deck.

Steel Deck – There is no damage to the primary or secondary bars other than surface corrosion on uncoated decks. Any deck coating system is sound. The grid deck is securely fastened to the floor system and any filler present is sound.

Timber Deck – There is no crushing, rotting, or splitting. The deck is tightly secured to the floor system.

7 GOOD CONDITION – Some minor problems.

Supplemental Rating Guidelines:

Concrete Deck – Insignificant cracks which can be sealed with tar or epoxy are present. There are few transverse cracks and only light scaling of the deck surface. No exposed reinforcing steel is present. There is no leaking or corrosion of stay-in-place forms.

Steel Deck – There may be minor damage to the primary or secondary bars, such as small twists or bends. There may be surface corrosion on uncoated decks, or minor isolated areas of corrosion of coated decks. Any filler present is sound.

Timber Deck – There is minor checking or splitting with a few loose planks.

6 **SATISFACTORY CONDITION** – Structural elements show some minor deterioration.

Supplemental Rating Guidelines:

Concrete Deck – Spalls and delaminations may be present on up to five percent of the deck surface or soffit area. Up to 10 percent of the deck surface or soffit area may have map cracking. Transverse cracking at greater than five-foot spacing may be present. Moderate scaling of the deck surface may also be present.

Steel Deck – There may be some twisted, bent, or cracked bars. There may be some isolated broken welds or loose/broken fasteners. Filler may have broken out at a few localized areas. There is surface corrosion on uncoated decks, and surface or freckle corrosion of coated decks.

Timber Deck – Less than 10 percent of the planks are checked or split, but they are sound. There may be some loose or moderately worn planks. Some areas of wetness are present.

5 **FAIR CONDITION** – All primary structural elements are sound, but some may have minor section loss, cracking, or spalling.

Supplemental Rating Guidelines:

Concrete Deck – Up to 10 percent of the deck surface or soffit area is spalled or delaminated. Up to 25 percent of the deck surface or soffit area may have map cracking. Transverse cracking on the underside at less than five-foot intervals in the majority of the deck, with or without efflorescence, may be present. The underside of the deck has spalls with exposed reinforcing bars with up to 10 percent section loss in isolated areas. Heavy scaling of the deck surface may also be present.

Steel Deck – There are some twisted, bent, or cracked bars and possibly a few broken or missing bars. There are some broken welds or loose/broken fasteners. Filler may have broken out at a few scattered locations. Some section loss may be occurring due to corrosion, but the section loss is not measurable. Section loss due to wear may be noticed in the wheel lines.

Timber Deck – Ten percent to 40 percent of the planks are checked, split, rotted, or crushed. Many planks are loose. Fire damage is limited to surface charring with minor, measurable section loss. Less than 10 percent of the planks are in need of replacement.

4 **POOR CONDITION** – Advanced section loss, deterioration, or spalling is present.

Supplemental Rating Guidelines:

Concrete Deck – Longitudinal cracks exist over the majority of the deck. Up to 25 percent of the deck surface or soffit area is spalled or delaminated. Up to 50 percent of the deck surface or soffit area may have map cracking. The underside of the deck has wet-looking areas. Stay-in-place forms are corroded in numerous areas. Full-depth failures are imminent. Significant efflorescence is present. The underside of the deck has spalls with exposed reinforcing bars with up to 30 percent section loss in isolated areas. Loose delaminations are in danger of falling on traffic or pedestrians below.

Steel Deck – There are numerous cracked, broken, or missing bars. There are numerous broken welds or loose/broken fasteners. Filler has broken out at many locations. Measurable surface pitting and/or section loss is occurring due to corrosion. The coating system has failed. Measurable section loss due to wear has occurred in the wheel lines.

Timber Deck – Over 40 percent of the planks are rotted, crushed, or split. Fire damage with significant section loss, possibly reducing the load-carrying capacity, may be present. Over 10 percent of the planks are in need of replacement.

3 **SERIOUS CONDITION** – Loss of section, deterioration, or spalling has seriously affected the components. Local failures are possible. Flexure and shear cracks in concrete may be present.

Supplemental Rating Guidelines:

Concrete Deck – Full-depth failures are present or imminent. Greater than 25 percent of the deck surface or soffit area is spalled or delaminated. Excessive efflorescence is present. Large areas on the underside of the deck look wet. Large areas of stay-in-place forms are corroded. Significant exposed reinforcing bars, with greater than 30 percent section loss, are present.

Steel Deck – There are numerous broken or missing bars. There are widespread broken welds or broken fasteners. Much of the filler is missing. Serious section loss and measurable section loss in the wheel lines is present.

Timber Deck – Severe signs of distress are visible. Extensive plank damage is evident with reduced deck load-carrying capacity.

2 **CRITICAL CONDITION** – Advanced deterioration of primary components is present. Fatigue cracks in steel or shear cracks in concrete may be present. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.

Supplemental Rating Guidelines:

All Decks – There are deficiencies in the deck that would likely cause a driver to lose control of his/her vehicle. Local deflections exist.

Concrete Deck – Full-depth failures exist over much of the deck. The deck is grossly compromised.

Steel Deck – There are widespread broken or missing bars accompanied with partial deck failures. There are widespread broken welds or broken fasteners. Most of the filler is missing. Excessive section loss is evident.

Timber Deck – There is advanced deterioration with partial deck failure. There are broken or missing planks.

1 **"IMMINENT" FAILURE CONDITION** – Major deterioration or section loss is present. The bridge is closed to traffic, but corrective action may put it back in light service.

0 **FAILED CONDITION** – The bridge is out of service, beyond corrective action.

SECTION 3.6 ADDITIONAL DECK RATINGS

Indiana requires the deck wearing surface to be rated for all bridges. Additional items to be rated for state-owned bridges are shown in Figure 4:3-5. Each item shall be rated as a stand-alone item, assessing its condition independently, and not how it might relate to Item 58, the NBIS deck condition rating. Each item shall be rated as follows unless noted:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor problems

6 **Satisfactory Condition** – structural elements show some minor deterioration

5 **Fair Condition** – minor section loss, cracking, or spalling

4 **Poor Condition** – advanced section loss, deterioration, or spalling

3 **Serious Condition** – loss of section, deterioration, or spalling has seriously affected components

2 **Critical Condition** – advanced deterioration of primary elements

1 **Imminent Failure Condition** – bridge closed to traffic, but corrective action may put bridge back in light service

0 **Failed Condition** – beyond corrective action

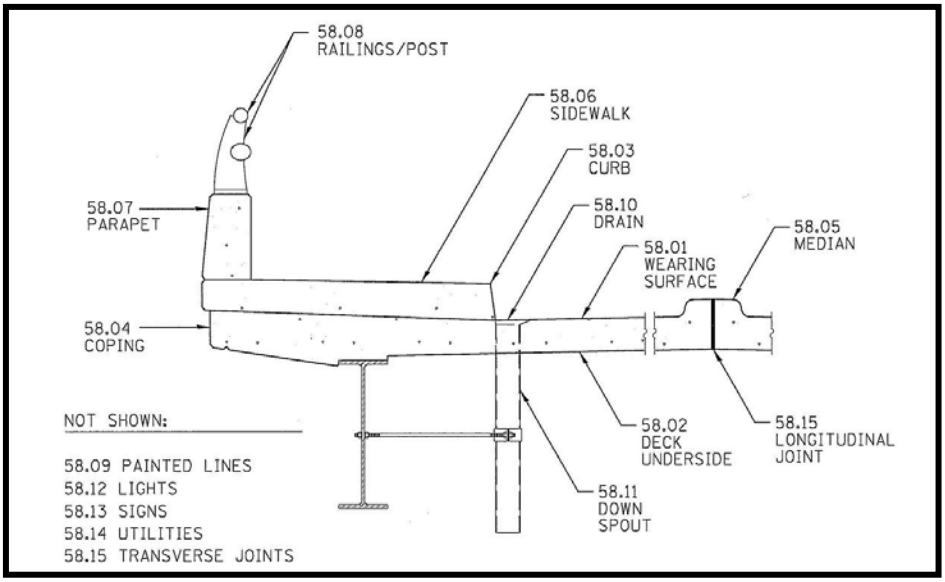

Figure 4:3-5: Additional Deck Items

ITEM 58.01 – WEARING SURFACE

The wearing surface is the portion of the top of the deck used for vehicle traffic. This rating is used for all decks, whether they are monolithic, or have an added wearing surface. The rating of wearing surface can be significantly different than the rating of the deck. The rating should be determined using the following guidelines:

N NOT APPLICABLE:

Supplemental Rating Guidelines: Used for structures without decks such as underfill structures or filled arch bridges.

9 EXCELLENT CONDITION:

Supplemental Rating Guidelines: Generally used on properly constructed, new bridge wearing surfaces.

Concrete Wearing Surface – There are no noticeable deficiencies.

Steel Wearing Surface – There are no noticeable deficiencies.

Timber Wearing Surface – There are no noticeable deficiencies.

Bituminous Wearing Surface – There are no noticeable deficiencies.

8 VERY GOOD CONDITION:

Supplemental Rating Guidelines: Generally used on properly constructed, new bridge wearing surfaces.

Concrete Wearing Surface – There are no spalls, delaminations, or scaling present. Minor transverse cracks may be present in the wearing surface.

Steel Wearing Surface – There is no damage to the primary or secondary bars other than surface corrosion on uncoated decks. Any deck-coating system is sound. Any concrete filler present is sound.

Timber Wearing Surface – There is no crushing, rotting, or splitting.

Bituminous Wearing Surface – There are no spalls or delaminations present. Minor transverse cracks may be present in the wearing surface.

7 GOOD CONDITION:

Concrete Wearing Surface – There are no spalls or delaminations. Cracks which can be sealed with tar or epoxy exist, or light scaling may be present.

Steel Wearing Surface – There may be minor damage to the primary or secondary bars, such as small twists or bends. There may be surface corrosion on uncoated decks, or minor isolated areas of corrosion of coated decks. Any filler present is sound.

Timber Wearing Surface – There is minor checking or splitting with a few loose planks.

Bituminous Wearing Surface – There are no spalls or delaminations. Sealed cracks are present.

6 SATISFACTORY CONDITION:

Concrete Wearing Surface – Up to five percent of the wearing surface area is spalled or delaminated. Up to 15 percent is patched. The patching is in good condition. Minor open cracking in the wearing surface (five-foot maximum spacing) or moderate scaling may be present.

Steel Wearing Surface – There may be some twisted, bent, or cracked bars. There may be some isolated broken welds or loose/broken fasteners. Filler may have broken out at a few localized areas. There is surface corrosion on uncoated decks, and surface or freckle corrosion of coated decks.

Timber Wearing Surface – Less than 10 percent of the planks are checked or split, but they are sound. There may be some loose or moderately worn planks.

Bituminous Wearing Surface – Up to five percent of the surface area is unsound (potholes, spalls, etc.). Up to 15 percent is patched. The patching is in good condition. Minor open cracking in the wearing surface (five-foot maximum spacing) may be present.

5 FAIR CONDITION:

Concrete Wearing Surface – Up to 15 percent of the wearing surface area is spalled or delaminated. Fifteen percent to 30 percent is patched. The patching is in fair condition. Less than 20 percent of the wearing surface is delaminated with no spalls or patching. Excessive open cracks or heavy scaling may be present.

Steel Wearing Surface – There are some twisted, bent, or cracked bars, and possibly a few broken or missing bars. Filler may have broken out at a few scattered locations.

Timber Wearing Surface – Ten percent to 40 percent of the planks are checked, split, rotted, or crushed. Many planks are loose. Fire damage is limited to surface charring with minor, measurable section loss. Less than 10 percent of the planks are in need of replacement.

Bituminous Wearing Surface – Five percent to 15 percent of the wearing surface area is unsound (potholes, spalls, etc.). Fifteen percent to 30 percent is patched. The patching is in fair condition. Excessive open cracks may exist in the wearing surface. Minor raveling may be present.

4 POOR CONDITION:

Concrete Wearing Surface – Up to 25 percent of the wearing surface area is spalled or delaminated. Thirty percent to 50 percent is patched and the patching is in poor condition.

Steel Wearing Surface – There are numerous cracked, broken, or missing bars. There are numerous broken welds or loose/broken fasteners. Filler has broken out at scattered locations. Measurable surface pitting and/or section loss is occurring due to corrosion. The coating system has failed. Measurable section loss due to wear in the wheel lines may be present.

Timber Wearing Surface – Over 40 percent of the planks are rotted, crushed, or split. Fire damage exists that has significant section loss. Over 10 percent of the planks are in need of replacement.

Bituminous Wearing Surface – Fifteen percent to 25 percent of the wearing surface area is unsound (potholes, spalls, etc.). Thirty percent to 50 percent is patched and the patching is in poor condition. Visible rutting or raveling may be present.

3 SERIOUS CONDITION:

Concrete Wearing Surface – Full-depth failures are present or imminent. Greater than 25 percent of the wearing surface area is spalled or delaminated. Over 50 percent of the surface is patched.

Steel Wearing Surface – There are numerous broken or missing bars. There are widespread broken welds or broken fasteners. Several areas of filler are missing. Serious section loss and measurable section loss due to wear in the wheel lines may be present.

Timber Wearing Surface – Extensive plank damage is evident.

Bituminous Wearing Surface – Greater than 20 percent of the wearing surface area is unsound (potholes, spalls, etc.). Over 50 percent is patched. Serious rutting or raveling may be present.

2 **CRITICAL CONDITION:**

All Wearing Surfaces – There are deficiencies in the deck that would likely cause a driver to lose control of his/her vehicle. Local deflections exist.

Concrete Wearing Surface – Full-depth failures exist over much of the wearing surface.

Steel Wearing Surface – There are widespread broken or missing bars accompanied with partial deck failures. There are widespread broken welds or broken fasteners. Much of the filler is missing. Excessive section loss is present.

Timber Wearing Surface – There are broken or missing planks.

Bituminous Wearing Surface – Full-depth failures exist over much of the wearing surface.

1 **FAILURE CONDITION** – Major deterioration in the wearing surface exists. The bridge is closed to traffic, but corrective action may put it back in light service.

0 **FAILED CONDITION** – The bridge is out-of-service, beyond corrective action.

Figure 4:3-6: Concrete Wearing Surface With No Noticeable Deficiencies

Figure 4:3-7: Concrete Wearing Surface With Patches and Spalls

Figure 4:3-8: Timber Plank Wearing Surface

Figure 4:3-9: Concrete Wearing Surface With Spalls and Patching

Figure 4:3-10: Bituminous Wearing Surface With Spalls and Patching

Figure 4:3-11: Concrete Wearing Surface With Extensive Patching and Spalls

ITEM 58.02 – DECK UNDERSIDE

This item rates the underside of the deck as described as NBI Item 58, above. The ratings follow those outlined above for Item 58 and, because the underside of the deck generally reflects the structural condition of the deck, Item 58.02 will usually match Item 58.

Figure 4:3-12: Deck Underside With Shrinkage Cracking

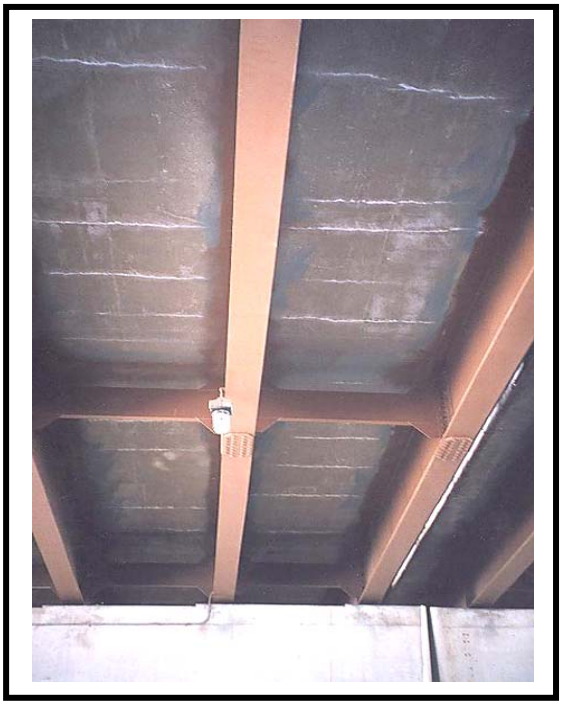

Figure 4:3-13: Deck Underside With Transverse Cracking

ITEM 58.03 – CURBS

Curbs are vertical concrete surfaces designed to keep traffic on the wearing surface and off of the bridge sidewalks or railings. Curbs keep water from draining over the bridge coping.

Inspection of concrete curbs should include the following items:

- Check the curb for delaminations, spalls, and exposed reinforcing steel.
- Inspect the curb for both vertical and transverse cracks.
- Inspect the curb for scaling or efflorescence. Note if it is stained with rust, since this condition suggests reinforcing steel corrosion.
- Check the curb for signs of corroding reinforcing steel, as indicated by rust stains or exposed reinforcement.
- Check previously repaired areas for soundness by hammer tapping.

Figure 4:3-14: Curb

Figure 4:3-15: Spalled and Crumbling Curb

Rate the physical condition of the curb and its ability to function as designed according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor cracking or scaling

6 **Satisfactory Condition** – some cracking, scaling, or delaminations

5 **Fair Condition** – general cracking, scaling, or delaminations

4 **Poor Condition** – up to 10 percent of curb is spalled, patched, or delaminated

3 **Serious Condition** – ten to 30 percent of curb is spalled, patched, or delaminated

2 **Critical Condition** – thirty to 50 percent of curb is spalled, patched, or delaminated

1 **Failure Condition** – greater than 50 percent of curb is spalled, patched, or delaminated

0 **Failed Condition** – crumbling

ITEM 58.04 – COPINGS

Copings are the outside, vertical faces of the bridge deck. Inspection of copings should include the following:

- Check for delaminations, spalls, and exposed reinforcing steel.
- Inspect for cracks, scaling, or efflorescence. Note if the efflorescence is stained with rust, since this condition suggests reinforcing steel corrosion.
- Check for signs of corroding reinforcing steel, as indicated by rust stains or exposed reinforcement.
- Check previously repaired areas for soundness by hammer tapping.

Rate the physical condition of the copings according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor cracking, or scaling.

6 **Satisfactory Condition** – some cracking, scaling, or delaminations

5 **Fair Condition** – general cracking, scaling, or delaminations

4 **Poor Condition** – up to 10 percent of coping is spalled, patched, or delaminated

3 **Serious Condition** – ten to 30 percent of coping is spalled, patched, or delaminated

2 **Critical Condition** – thirty to 50 percent of coping is spalled, patched, or delaminated

1 **Failure Condition** – greater than 50 percent of coping is spalled, patched, or delaminated

0 **Failed Condition** – crumbling

Figure 4:3-16: Coping

ITEM 58.05 – MEDIAN

Medians are areas of raised concrete or steel located between opposing travel lanes to keep traffic separated. Inspection of the median should include the following:

- Check for delaminations, spalls, and exposed reinforcing steel.
- Inspect for cracks, scaling, and efflorescence.
- Check the curb for signs of corroding reinforcing steel, as indicated by rust stains or exposed reinforcement.
- Check previously repaired areas for soundness by hammer tapping.

Note the type of median and rate the physical condition of the median and its ability to function as designed according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor cracking or scaling

6 **Satisfactory Condition** – some cracking, scaling, or delaminations

5 **Fair Condition** – general cracking, scaling, or delaminations

4 **Poor Condition** – up to 10 percent of median is spalled, patched, or delaminated

3 **Serious Condition** – ten to 30 percent of median is spalled, patched, or delaminated

2 **Critical Condition** – thirty to 50 percent of median is spalled, patched, or delaminated

1 **Failure Condition** – greater than 50 percent of median is spalled, patched, or delaminated

0 **Failed Condition** – crumbling

Figure 4:3-17: Concrete Median

Figure 4:3-18: Concrete Median Barrier Wall

ITEM 58.06 – SIDEWALKS

Sidewalks are areas designated for pedestrian traffic. They are generally raised to provide separation from vehicular traffic. Any hazard that could potentially result in harm to the public should be noted on the inspection form and reported to the structure owner. Inspection of concrete sidewalks should include the following:

- Checking the sidewalk for delaminations, spalls, pop-outs, and exposed reinforcing steel. Large spalls or exposed rebar can pose tripping hazards to pedestrians.
- Note any loose or misaligned expansion joint plates that pose a tripping hazard to pedestrians.
- Inspect the sidewalk for cracks.
- Check the sidewalk for signs of corroding reinforcing steel, as indicated by rust stains or exposed reinforcement.
- Check previously repaired areas for soundness by hammer tapping.
- Notify the owners of any sidewalks that pose a tripping hazard.

Figure 4:3-19: Sidewalk With Minor Pop-Outs

Figure 4:3-20: Sidewalk With Rust Stains and Minor Spalling

Rate sidewalks for the walking surface quality and accessibility according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor cracking or scaling

6 **Satisfactory Condition** – some cracking, scaling, or delaminations; accessible; and no hazard to pedestrians or motorists

5 **Fair Condition** – general cracking, scaling, or delaminations and minor hazards or barriers to accessibility

4 **Poor Condition** – not accessible and hazards to pedestrians or motorists present; up to 10 percent of sidewalk is spalled, patched, or delaminated

3 **Serious Condition** – not accessible and hazards to pedestrians or motorists present; 10 to 30 percent of sidewalk is spalled, patched, or delaminated

2 **Critical Condition** – not accessible and hazards to pedestrians or motorists present; 30 to 50 percent of the sidewalk is spalled, patched, or delaminated

1 **Failure Condition** – not accessible and hazards to pedestrians or motorists present; greater than 50 percent of the sidewalk is spalled, patched, or delaminated

0 **Failed Condition** – sidewalk is unusable

Figure 4:3-21: Sidewalk With Spalling and Delaminations

ITEM 58.07 – PARAPET

Parapets are concrete railings or concrete barriers. The primary function of a parapet is to keep errant vehicles on the bridge. Additionally, if there is foot traffic, the parapet should keep pedestrians and bicycles on the bridge and provide a minimum level of comfort while crossing. They can also protect the main load-carrying elements of certain superstructure types, such as through trusses and arches, from damage due to vehicular impacts. Inspection of parapets should include the following:

- Look for signs of impact damage such as spalls and localized heavy cracking. The location, severity, and size of the damage should be documented.
- Check for delaminations, spalls, exposed reinforcing steel, and scaling.
- Inspect the parapet for both vertical and transverse cracks.
- Check the entire member for signs of corroding reinforcing steel as indicated by rust stains or exposed reinforcement.
- Look for efflorescence and note if it is stained with rust, since this condition suggests reinforcing steel corrosion.
- Check previously repaired areas for soundness by hammer tapping.
- Check that any anchorage is sound.

Figure 4:3-22: Parapet With Scaling

Rate the parapet according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor cracking or scaling

6 **Satisfactory Condition** – some cracking, scaling, or delaminations

5 **Fair Condition** – general cracking, scaling, or delaminations

4 **Poor Condition** – up to 10 percent of parapet is cracked or spalled; hazards to pedestrians or motorists present

3 **Serious Condition** – ten to 30 percent of parapet is cracked or spalled; hazards to pedestrians or motorists present; anchorage deficiencies present; and moderate efflorescence present

2 **Critical Condition** – thirty to 50 percent of parapet is spalled, patched, or delaminated; hazards to pedestrians or motorists and significant efflorescence present

1 **Failure Condition** – greater than 50 percent of parapet is spalled, patched, or delaminated; hazards to pedestrians or motorists and significant efflorescence present.

0 **Failed Condition** – crumbling

Figure 4:3-23: Parapet With Spalling

ITEM 58.08 – RAILING/POST

Railings/posts are the wood or metal components of bridge railings. Rate railings and posts for cracks and section loss in metal components, and for splitting, rot, and insect attack in timber components. Note any impact damage. Special attention must be given to the size, type, and spacing of fasteners and the anchorage. Inspection of railings and posts should include the following items:

- Look for damage caused by vehicular collisions.
- Report any loose connections or anchorage.
- Check the horizontal and vertical alignments.
- Examine timber members for splits, checks, and decay.
- Check metal members for corrosion and section loss.
- Notify owner of any damaged railing that would be unable to redirect an errant vehicle.
- Check that railing meets current design criteria.

Rate the railing/post according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new; meets current design criteria

8 **Very Good Condition** – no problems noted; meets current design criteria

7 **Good Condition** – some minor problems; meets current design criteria

6 **Satisfactory Condition** – elements show some minor deterioration; no hazard to pedestrians or motorists; meets current design criteria

5 **Fair Condition** – structurally sound; does not meet current design criteria

4 **Poor Condition** – any hazard to pedestrians or motorists; does not meet current design criteria; up to five percent of sections are missing, corroded through, or broken; horizontal or vertical misalignment; up to five percent loose connections or anchorage

3 **Serious Condition** – any hazard to pedestrians or motorists; does not meet current design criteria; five percent to 10 percent of sections are missing, corroded through, or broken; less than five percent to 10 percent loose connections or anchorage

2 **Critical Condition** – any hazard to pedestrians or motorists; does not meet current design criteria; 10 percent to 20 percent of sections are missing, corroded through, or broken; 10 percent to 20 percent loose connections or anchorage

1 **Failure Condition** – any hazard to pedestrians or motorists; does not meet current design criteria; more than 20 percent of sections are missing, corroded through, or broken

0 **Failed Condition** – any hazard to pedestrians or motorists; does not meet current design criteria; not providing value as a railing or post

Figure 4:3-24: Guardrail With Collision Damage

Figure 4:3-25: Steel Railing/Post

Figure 4:3-26: Steel Railing/Post

Figure 4:3-27: Steel Railing/Post With Minor Corrosion

Figure 4:3-28: Timber Railing/Post With Minor Checks

Figure 4:3-29: Railing/Post Does Not Meet Design Criteria

Figure 4:3-30: Railing/Post With Missing Section

Figure 4:3-31: Steel Railing on Concrete Parapet

Figure 4:3-32: Metal Railing

Figure 4:3-33: Metal Railing With Missing Support

Figure 4:3-34: Corroded Metal Railing

ITEM 58.09 – PAINTED LINES

Rate the overall condition of lines painted on the wearing surface, considering visibility, reflectivity, and coverage.

Figure 4:3-35: Painted Lines

Figure 4:3-36: Painted Lines in Very Good Condition

ITEM 58.10 – DRAINS

A drainage system should remove water from the structure as quickly and completely as possible without causing erosion below the structure. Poor or insufficient drainage can cause a range of problems. Deck drains are receptacles to receive water. Deck drains include simple holes through the deck, slots at the base of a concrete parapet, and inlet boxes (scuppers).

Figure 4:3-37: Deck Drain

Figure 4:3-38: Deck Drain Inoperable

Inspection of deck drains should include the following items:

- Check the deck drains for debris accumulation (plant growth, sand, gravel, and trash).
- Note any inlets or inlet grates that are deteriorated, broken, or missing. Broken grates that are hazards to traffic or pedestrians should be reported immediately.
- Look for evidence of ponding on the deck, such as debris accumulation in the gutters or low spots. Try to determine why roadway water is not getting to drains, and note these reasons on the inspection form. Notify the owner of any drains that allow ponding on the bridge deck.
- Examine the embankments and slopes for evidence of erosion. Clogged drainage systems force more runoff water onto these areas, increasing the erosion potential.

Rate the condition of the deck drains, as seen from the deck, including alignment, using the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor problems

6 **Satisfactory Condition** – some minor deterioration or clogging; operating properly

5 **Fair Condition** – partially clogged; minor misalignment

4 **Poor Condition** – clogged; misalignment interferes with function; any hazard to pedestrians or motorists

3 **Serious Condition** – inoperable drainage

2 **Critical Condition** – unless closely monitored, may be necessary to close the bridge until corrective action is taken

1 **Failure Condition** – bridge closed to traffic, but corrective action may put it back in light service

0 **Failed Condition** – bridge closed to traffic; beyond corrective action

Figure 4:3-39: Clogged Deck Drain

ITEM 58.11 – DOWN SPOUTS/DRAIN PIPES

Down spouts and drainage pipes carry runoff away from the drain and off of the superstructure and substructure. Runoff water that drains directly onto the superstructure or substructure may corrode structural steel, deteriorate concrete piers, and contribute to erosion of earthen abutment slopes.

Inspection of down spouts and drain pipes should include the following:

- Check for clogging and debris accumulation.
- Examine down spouts and drain pipes and their fittings for splits, breaks, or disconnected pipes.
- Check to see that clean outs are in place and operating.
- Look for any missing or broken pipe brackets and check to see that all components are supported properly.

- Check the condition of any rubber down spout boots. Rubber boots connect a fixed rigid pipe (such as a pipe attached to a pier) to a movable rigid pipe (such as an outlet pipe) at expansion joints. These flexible boots allow superstructure expansion and contraction without breaking the downspout.
- Check that drains do not allow water to run onto superstructure or substructure elements.

Rate the overall condition of the down spouts or drain pipes, as seen from under the deck, according to the following criteria. Note any clogs.

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – minor problems

6 **Satisfactory Condition** – some minor deterioration; operating properly

5 **Fair Condition** – partially clogged; minor misalignment; some erosion of embankment

4 **Poor Condition** – clogged; misalignment interferes with function; any hazard to pedestrians; channels water onto superstructure or substructure, causing damage; erosion of embankment

3 **Severe Condition** – severe erosion of embankment; channels water onto superstructure or substructure elements

2 **Critical Condition** – inoperable

1 **Failure Condition** – inoperable

0 **Failed Condition** – missing

Figure 4:3-40: Down Spout With Crushed Section

Figure 4:3-41: Down Spout

Figure 4:3-42: Down Spout System

Figure 4:3-43: Broken Down Spout in Box Section

ITEM 58.12 – LIGHTS

Rate the overall condition of any lighting or lighting supports on the bridge. On concrete supports, look for spalls and cracks. On steel supports, check for corrosion and cracks. On aluminum supports, check for fatigue cracks, particularly on roadway lights. On timber supports, check for rotting, insect attack, and splitting. Check all supports for loose connections, vandalism, alignment, and collision damage.

Rate the overall condition of the lights according to the following criteria:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor problems

6 **Satisfactory Condition** – elements show some minor deterioration

5 **Fair Condition** – structurally sound, but some deterioration such as corrosion, rot, or splitting of lighting units; lights functioning properly; no hazard to pedestrians or motorists

4 **Poor Condition** – structural condition of the lighting units is deteriorated; lights not operating as designed; hazard to pedestrians or motorists

3 **Serious Condition** – possibility of structural failure; lights not operating as designed

2 **Critical Condition** – unless closely monitored, may be necessary to close the bridge until corrective action is taken

1 **Failure Condition** – bridge closed to traffic, but corrective action may put it back in light service

0 **Failed Condition** – bridge closed to traffic; beyond corrective action

Figure 4:3-44: Lighting Support With Deteriorated Grout Pad

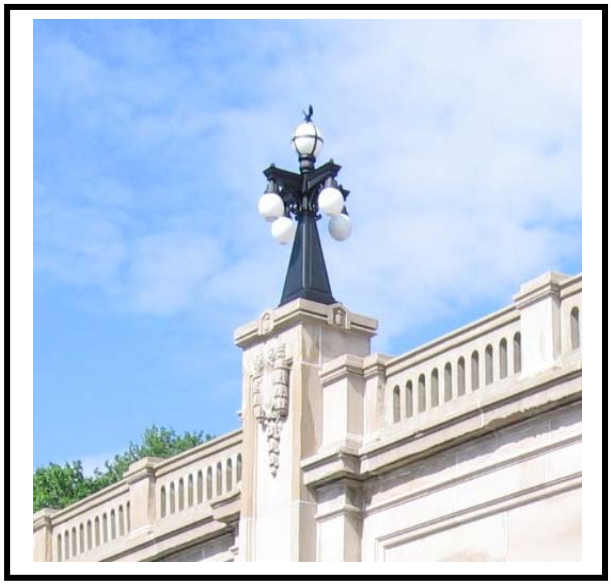

Figure 4:3-45: Bridge Lighting

ITEM 58.13 – SIGNS

Signs are critical to the public safety. Signs must be posted at each bridge approach in a location that is near the bridge, but will also allow vehicles to change direction if the signs restrict the bridge.

Common signs found on bridges include the following:

- **Object markers**: Used at most highway bridges to warn the traveling public of the approaching crossing. This is most often a Type 3 object marker, mounted at the ends of the bridge rail. These are rectangular, vertically oriented signs with diagonal black and yellow stripes.
- **Narrow bridge:** Used when the bridge horizontal clearance of a two-way road is between 16 feet and 18 feet, or when the bridge roadway clearance is less than the width of the approach travel lanes.
- **One-lane bridge:** Used when the bridge horizontal clearance of a two-way road is less than 16 feet. If commercial vehicles constitute a high proportion of the traffic, or if the approach sight distance is limited, the bridge would be considered one-lane if the horizontal clearance is less than 18 feet.
- **Vertical clearance:** Used when the vertical clearance of the traveled way under the bridge is less than 14 feet, six inches. The clearance in feet and inches is always printed on this sign.

- **Weight limit posting:** Used to indicate a weight restriction on the bridge. The allowable load is always printed on this sign. See Part 1, Chapter 9 for Load Posting Information.
- **Other:** Posted signs related to the bridge, such as curve warning signs, high water signs, "Watch for Ice on Bridge" signs, or "Bridge Out" signs.

Figure 4:3-46: Vandalized Object Marker Sign

Rate the condition of the bridge's signage. Items that must be considered include the following:

- Look at visual items such as legibility, reflectivity, faded paint, and obstructing vegetation or dirt.
- Look at message effectiveness and clarity.
- Examine support structural condition and deterioration.
- Evaluate the physical condition of the sign board and post, such as traffic impacts, loss of foundation material, or lateral support.
- Watch for vandalism such as graffiti, damage, or a missing sign.

Rate the overall condition of any signs or sign supports on the bridge in accordance with the following criteria:

N **Not Applicable** – no signs

9 **Excellent Condition** – new signs

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor problems

6 **Satisfactory Condition** – elements show some minor deterioration

5 **Fair Condition** – deterioration such as corrosion, rot, or splitting on sign supports; signs' messages applicable and readable; no hazard to pedestrians or motorists

4 **Poor Condition** – structural condition of signs is deteriorated; signs are incorrect, inapplicable, or unreadable; any hazard to pedestrians or motorists

3 **Serious Condition** – possibility of structural failure; signs are incorrect, inapplicable, or unreadable; any hazard to pedestrians or motorists

2 **Critical Condition** – unless closely monitored, may be necessary to close the bridge until corrective action is taken

1 **Failure Condition** – bridge closed to traffic, but corrective action may put it back in light service

0 **Failed Condition** – bridge closed to traffic; beyond corrective action

Figure 4:3-47: Cracked Sign Support

Figure 4:3-48: Defaced Weight Limit Sign and End Marker

ITEM 58.14 – UTILITIES

Utility companies are often given permission to mount their services on a bridge. These could include gas lines, telephone lines, or sewer line. The utility owner is responsible for the adjustments, repairs, or restoration of their attachments to the bridge. Utilities are mounted on bridges by permit. Utility owners must be notified of problems. Failure of the utility owner to act promptly to eliminate hazards or utilities in poor condition is reason to rescind the permit.

Inspection of utilities should include the following:

- Note any utilities on the bridge, the location of the utilities, and any visible problems with their condition, supports, or hangers.
- Report any hazards to motorists or pedestrians posed by the utility to the utility and to the bridge owner.
- Look for leaks, breaks, corrosion, loose wires, or bad insulation.
- Check that utilities are not reducing the vertical clearance or freeboard.

Rate the overall condition of any utilities or their supports on the bridge and note the type of utility. Utilities that are close to the bridge and that may affect the bridge function should be noted. Describe any unknown utilities in the notes.

Figure 4:3-49: Utility Supported on Bridge

ITEM 58.15 – LONGITUDINAL JOINTS

Longitudinal joints are joints parallel to the direction of travel. In addition to the condition rating of each joint, the joint type needs to be identified. Inspection of longitudinal joints should include the following:

- Check for horizontal or vertical displacements or misalignments of the joint or its elements.
- Check for debris in the joint and deterioration of the joint materials or anchorage of the joint.
- Check for leaking or discoloration of the underside of the deck in the vicinity of the joint.
- Record the approximate air temperature (Fahrenheit) and the width of the joint opening, in inches, on each end of each joint.

Rate the overall condition of longitudinal joints on the bridge in accordance with the following:

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor problems

6 **Satisfactory Condition** – some minor deterioration

5 **Fair Condition** – deterioration or misalignment, minor leaking, or minor debris

4 **Poor Condition** – damaged and/or misaligned; horizontal or vertical displacement, creating a hazard; significant debris; significant leaking

3 **Serious Condition** – advanced damage, misalignment, and/or displacement; hazardous

2 **Critical Condition** – unless closely monitored, may be necessary to close the bridge until corrective action is taken

1 **Failure Condition** – bridge closed to traffic, but corrective action may put it back in light service

0 **Failed Condition** – bridge closed to traffic; beyond corrective action

ITEM 58.16 – TRANSVERSE JOINTS

Expansion joints provide for thermal expansion and contraction of the deck and superstructure. The clear opening of the joint should provide adequate space for movement of the adjacent superstructure elements. Joints also fill the gap between deck and abutment backwall to provide a smooth ride for vehicles transitioning onto and off the bridge. They must also be durable enough to withstand the abuse from traffic wheel loads, snow plow blades, road debris, sunlight, freezing, and deicing chemicals.

Transverse joints are joints perpendicular to the direction of travel. In addition to the condition rating of each joint, the location of each joint and the joint type needs to be identified.

Inspection of transverse joints should include the following:

- Check that there are no horizontal or vertical displacements or misalignments of the joint or its elements.
- Check for debris in the joint.
- Check for deterioration of the joint materials and anchorage of the joint.
- Check for leaking or discoloration of the underside of the deck in the vicinity of the joint.
- Note any overlays placed over the joint.
- Listen for any rattles or indications of component looseness as traffic drives over the joint.
- Check the support condition from below the deck. Look for broken welds and corrosion.
- Record the approximate air temperature (Fahrenheit) and the width of the joint opening, in inches, on each end of each joint.

Rate the overall condition of any transverse joints on the bridge according to the criteria below. Record the type of joint. Estimate the length of the joints using National Bridge Inventory (NBI) Item 51 or 52. If more than one type of transverse joint is used on the bridge, enter the data for the most critical type. List other joint types in the notes.

N **Not Applicable**

9 **Excellent Condition** – new

8 **Very Good Condition** – no problems noted

7 **Good Condition** – some minor problems

6 **Satisfactory Condition** – some minor deterioration

5 **Fair Condition** – deterioration and/or misalignment; minor leaking; minor debris

4 **Poor Condition** – damaged and/or misaligned; horizontal or vertical displacement, creating a hazard; significant debris; significant leaking

3 **Serious Condition** – advanced damage, misalignment, or displacement; hazardous

2 **Critical Condition** – unless closely monitored, may be necessary to close the bridge until corrective action is taken

1 **Failure Condition** – bridge closed to traffic, but corrective action may put it back in light service

0 **Failed Condition** – bridge closed to traffic; beyond corrective action

Figure 4:3-50: Transverse Joint

Figure 4:3-51: Transverse Joint with Debris

Figure 4:3-52: Transverse Joint with Deck Cracks Suggesting a Failing Anchorage System

Figure 4:3-53: Transverse Finger Plate Expansion Joint